

Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants: Joseph P. Rynd, *et al.*
Application No.: 10/722,929
Filing Date: November 26, 2003
Confirmation No.: 1182
Group Art Unit: 1791
Examiner: Jeffrey Wollschlager
Title: Method Of Forming Thermoplastic Foams Using Nano-
Particles To Control Cell Morphology

Commissioner for Patents
Mail Stop Appeal Brief - Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. §41.37

In accordance with the provisions of 37 C.F.R. §41.37, Appellants submit the following Brief on Appeal.

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Owens Corning Intellectual Capital, LLC.
Assignment of the application was recorded on August 9, 2007 at Reel 019795, Frame 0433.

II. RELATED APPEALS AND INTERFERENCES

There are no known appeals or interferences that will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

The status of the claims is as follows:

Claims 1-8, 10-15, and 21 are rejected, pending, and appealed.

Claims 9, 16-20, and 22-26 are canceled.

IV. STATUS OF AMENDMENTS

Claim amendments were made subsequent to the final rejection set forth in the Office Action dated November 20, 2008. The proposed amendments set forth in the Amendment After Final filed on January 16, 2009 were denied entry.

V. SUMMARY OF CLAIMED SUBJECT MATTER

According to the features set forth in claim 1, and referring to the illustrated embodiments for explanation and not for limitation, a method for manufacturing a rigid foam board is provided. (See, e.g., paragraph [0008]). The method includes incorporating nano-particles selected from calcium carbonate, intercalated graphites, and expanded graphites having a particle size in at least one dimension less than 100 angstroms into a polymer melt that includes an alkenyl aromatic polymer material. (See, e.g., paragraphs [0008]-[0011], [0021], [0022], [0031], and [0032]). A blowing agent is also incorporated into the polymer melt under a first pressure and at a first temperature. (See, e.g., paragraphs [0008] and [0023]). The polymer melt is extruded under a second pressure and at a second temperature where the second temperature is sufficient to allow the polymer melt to expand and form a foam board. (See, e.g., paragraph [0008] and Table 1). The foam board is then cooled. (See, e.g., paragraph [0008], Table 1, and original claim 1). The foam board has an average cell size between 60 μm and 120 μm and a cell size distribution. (See, e.g., paragraph [0020] and original claim 15).

Claim 21 recites a method of manufacturing a rigid foam board that includes incorporating acicular calcium carbonate having a particle size in at least one dimension less than 100 angstroms and at least one nucleating agent into a polymer melt. (See, e.g., paragraphs [0008], [0011], [0021], and [0031]). A blowing agent is incorporated into the polymer melt under a first pressure and at a first temperature. (See, e.g., paragraphs [0008] and [0023]). The polymer melt is extruded under a second pressure and at a second temperature where the second temperature is sufficient to allow the polymer melt to expand and form a foam board. (See, e.g., paragraph [0008] and Table 1). The foam board is then cooled. (See, e.g., paragraph [0008], Table 1, and original claim 1). The polymer melt includes an alkenyl aromatic polymer material and the foam has a cell orientation of at least about 1.4. (See, e.g., paragraphs [0011] and [0022]).

Mapping the separately argued claims to the specification:

Claim 1: A method of manufacturing a rigid foam board (paragraph [0008]) consisting essentially of:

incorporating nano-particles into a polymer melt (paragraph [0008]), said nano-particles being selected from calcium carbonate, intercalated graphites and expanded

graphites (paragraphs [0008]-[0011], [0031], and [0032]) and having a particle size in at least one dimension less than 100 angstroms (paragraph [0021]);

incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature (paragraphs [0008] and [0023]);

extruding the polymer melt under a second pressure and at a second temperature, the second pressure and second temperature being sufficient to allow the polymer melt to expand and form a foam board (paragraph [0008] and Table 1); and

cooling the foam board (paragraph [0008], Table 1, and original claim 1), said foam board having an average cell size between 60 μm and 120 μm and having a cell size distribution (paragraph [0020] and original claim 15);

wherein said polymer melt includes an alkenyl aromatic polymer material (paragraph [0022]).

Claim 21: A method of manufacturing a rigid foam board paragraph [0008]) consisting essentially of:

incorporating acicular calcium carbonate (paragraphs [0011] and [0031]) and at least one nucleating agent into a polymer melt (paragraph [0008]), said acicular calcium carbonate having a particle size in at least one dimension less than 100 angstroms (paragraph [0021]);

adding a blowing agent to said polymer melt under a first pressure and at a first temperature (paragraphs [0008] and [0023]);

extruding said polymer melt under a second pressure and at a second temperature, said second pressure and said second temperature being sufficient to allow said polymer melt to expand and form a foam board (paragraph [0008] and Table 1); and

cooling said foam board (paragraph [0008], Table 1, and original claim 1);

wherein said polymer melt includes an alkenyl aromatic polymer material (paragraph [0022]), and

wherein said foam has a cell orientation of at least about 1.4 (paragraph [0011]).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds of rejection to be reviewed are as follows:

- (1) Whether the subject matter of claims 7 and 8 are indefinite under 35 U.S.C. §112, second paragraph.
- (2) Whether WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of U.S. Patent Publication No. 2005/0027040 to Nelson, *et al.* ("Nelson") render the subject matter recited in claims 1-8 and 10-15 obvious under 35 U.S.C. §103(a).
- (3) Whether WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of U.S. Patent No. 6,589,6456 to Morgenstern ("Morgenstern") render the subject matter recited in claims 1-8, 10-12, 14, and 15 obvious under 35 U.S.C. §103(a).
- (4) Whether WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of WO 2003/055804 to Chen, *et al.* ("Chen") and U.S. Patent No. 7,160,929 to Tan ("Tan") render the subject matter of claims 1-8, 10-12, 14-15, and 21 obvious under 35 U.S.C. §103(a).
- (5) Whether WO 2001/40362 to Miller, *et al.* ("Miller") in view of WO 2003/055804 to Chen, *et al.* ("Chen") and U.S. Patent No. 7,160,929 to Tan ("Tan") render the subject matter of claim 21 obvious under 35 U.S.C. §103(a).

VII. ARGUMENTS

A. Indefiniteness Rejection under 35 U.S.C. §112, second paragraph

Appellants respectfully submit that the transitional phrase “consisting essentially of” limits the scope of a claim to the specified materials and those materials that “do not materially affect the basic and novel characteristics of the claimed invention.”¹ Thus, it is respectfully submitted that claim 1, from which claims 7 and 8 depend, can include additional features, such as, for example, the addition of additives, so long as they do not materially affect the basic and novel characteristics of the claimed method. Appellants respectfully submit that the additives claimed in claims 7 and 8 are defined in the application at least in paragraph [0023] as additives for improving the processing or modifying the properties of the foam (e.g., fire retardancy). A fire retardant additive is disclosed in paragraph [0031] of the application as one specific example of an additive. It is respectfully submitted that the claimed additives are not deleterious and do not materially affect the basic and novel characteristics of the method claimed in claim 1. As such, Appellants respectfully submit that the claimed additives are permissible claimed features and claims 7 and 8 are sufficiently definite.

In sum, claims 7 and 8 stand rejected under 35 U.S.C. §112, second paragraph as being indefinite. It is respectfully submitted that claims 7 and 8, as presently recited, as definite. Accordingly, Appellants respectfully submit that the rejection of claims 7 and 8 as being indefinite should be reversed.

B. Obviousness Rejection under 35 U.S.C. §103(a) over Claims 1-8 and 10-15

In rejecting claims 1-8 and 10-15 as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* (“Grinshpun”) in view of U.S. Patent Publication No. 2005/0027040 to Nelson, *et al.* (“Nelson”), Appellants respectfully submit that the Office has incorrectly interpreted the cited references and has therefore failed to establish a *prima facie* case of obviousness.

Appellants respectfully submit that claim 1 defines a method of manufacturing a rigid foam board that is not taught or suggested by Grinshpun and Nelson. In addition, Appellants

¹ See, e.g., *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 6, August 2007, §2111.03.

respectfully submit that neither Grinshpun nor Nelson teaches or suggests the combination of features recited in claim 1.

Grinshpun teaches a foamable composition that is extruded through a die having a plurality of orifices, each of which forms a hollow extrudate. (*See, e.g.*, page 2, lines 19-21 and page 20, lines 22-24). The hollow extrudate is converted into foamed hollow extrudate strands at a temperature that promotes bubble stability. (*See, e.g.*, page 2, lines 22-24 and page 20, lines 26-28). The final step includes permitting the hollow strands to contact and adhere to each other to form a hollow, multi-strand polymer foam extrudate. (*See, e.g.*, page 2, lines 25-28 and page 20, lines 28-31).

Appellants respectfully submit that there is simply no teaching or suggestion within Grinshpun of extruding a polymer melt under a second pressure and at a second temperature where the second pressure and second temperature are sufficient to allow the polymer melt to expand and form a foam board as is required in claim 1. Indeed, the extrusion die in Grinshpun is specifically chosen so that it forms hollow tubes, not a foam board. It is through a coalescing step that these hollow tubes are joined together to form a hollow, multi-strand extrudate. (*See, e.g.*, page 2, lines 14-28 and page 20, lines 28-31 of Grinshpun). Appellants submit that there is no teaching or suggestion within Grinshpun of extruding a foam board as claimed in claim 1. Nelson does not teach or suggest a foam board, and as such, cannot make up for the deficiencies of Grinshpun. Accordingly, it is respectfully submitted that the combination of the teachings of Grinshpun and Nelson would not result in the inventive method of claim 1.

In the outstanding final Office Action, it is asserted that the foam sheet produced by the coalescing step is a foam board in accordance with the plain meaning of the term, and as a result, the rejection was maintained.² Appellants respectfully disagree, and submit that a "board" is a rigid material.³ As is well known by those of skill in the art, foam board insulation is a sheet of rigid foam used in nearly all aspects of building construction to

² *See, e.g.*, page 11, lines 3-4 of the Office Action dated November 20, 2008.

³ *See, e.g.*, <http://www.thefreedictionary.com/board> defining "board" as a "flat piece of wood or similarly rigid material adapted for a special use".

provide thermal resistance.⁴ Accordingly, it is respectfully submitted that the foam "board" recited in the claims and described in the application defines a rigid structure.

As taught at least by Table 1 on page 10 of the application, the foam is extruded by a flat face die/shaper plate or a flat slot die. As one of skill in the art would appreciate, such dies form solid, rigid foam structures and *not* hollow tubes as are extruded by the multi-orifice die of Grinshpun. (See, e.g., page 2, lines 19-21 and page 20, lines 22-24 of Grinshpun). Appellants respectfully submit that in the present invention, the foam board of claim 1 has a rigid foam structure, unlike the hollow tubular structures taught by Grinshpun. Moreover, it is respectfully submitted that the foam "sheet" formed by the coalesced hollow tubes of Grinshpun cannot be a rigid structure, at least partially due to the lack of material within the individual foam tubes. Indeed, Grinshpun expressly teaches that the hollow foam strands are flexible and compressible. (See, e.g., page 10, lines 17-20 of Grinshpun). Accordingly, the foam structure of Grinshpun cannot be a foam board (*i.e.* rigid foam board) as is required by independent claim 1.

In addition, Appellants submit that Grinshpun teaches away from a method of manufacturing a rigid foam board that includes the step of extruding a polymer melt under a second pressure and at a second temperature that allows the polymer melt to expand and form a foam board. As discussed above, Grinshpun specifically teaches the extrusion of a hollow extrudate. (See, e.g., page 2, lines 22-24 and page 20, lines 26-28). Additionally, as discussed previously, a board (*i.e.*, the claimed foam board) has a rigid structure. In contrast, the hollow tubes of Grinshpun are both flexible and compressible. (See, e.g., page 10, lines 17-20 of Grinshpun). Appellants respectfully submit that there is simply no teaching or suggestion within Grinshpun of extruding a rigid foam board. It is therefore respectfully submitted that one of skill in the art reading Grinshpun would be drawn away from extruding a polymer melt under a second pressure and at a second temperature which permits the polymer melt to expand and form a foam board as is claimed in claim 1 because Grinshpun

⁴ See, e.g., <http://www.wisegeek.com/what-is-foam-board-insulation.htm>.

fails to teach a rigid structure. Accordingly, Grinshpun fails to constitute the substantial evidence necessary to render the claimed invention obvious as a matter of law.⁵

In addition, Appellants submit that there is no motivation for one of skill in the art to arrive at a method of manufacturing a rigid foam board as claimed in claim 1 based on the disclosures of Grinshpun and Nelson. As is well established, in order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.⁶ Additionally, obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so.⁷

Appellants submit that one of ordinary skill in the art would simply not be motivated to arrive at the method of claim 1 based on the teachings of Grinshpun and Nelson because neither Grinshpun nor Nelson teaches or suggests method of manufacturing a rigid foam board that includes the step of extruding a polymer melt under a second pressure and at a second temperature that allows the polymer melt to expand and form a foam board as is required in independent claim 1. Indeed, the hollow tubes of Grinshpun are both flexible and compressible. Furthermore, Grinshpun teaches away from extruding a foam board as understood by those in the art. Accordingly, Appellants respectfully submit that the Office has failed to establish a *prima facie* case of obviousness.

Also, as discussed above, neither Grinshpun nor Nelson teaches or suggests a rigid foam board. Therefore, Appellants respectfully submit that Grinshpun and Nelson, alone or

⁵ See, e.g., *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596, 1599 (Fed. Cir. 1988) (holding it error to find obviousness where references as a whole "diverge from and teach away from the invention at hand.").

⁶ See, e.g., *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 6, August 2007, §2142.

⁷ See, e.g., *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 6, August 2007, §2142 citing *In re Kahn*, 441 F.3d 977, 986, 78 USPQ2d 1329, 1335 (Fed. Cir. 2006).

in combination, fail to teach all of the claim limitations set forth in claim 1. Accordingly, it is respectfully submitted that a *prima facie* case of obviousness has not been established for this additional reason.

In view of the above, it is respectfully submitted that independent claim 1 is not taught or suggested by Grinshpun and Nelson and that claim 1 is therefore non-obvious and patentable. With respect to dependent claims 2-8 and 10-15, Appellants submit that because independent claim 1 is not taught or suggested by Grinshpun or Nelson and claims 2-8 and 10-15 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2-8 and 10-15 are also not taught or suggested by Grinshpun and/or Nelson.

In sum, claims 1-8 and 10-15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of U.S. Patent Publication No. 2005/0027040 to Nelson, *et al.* ("Nelson"). It is respectfully submitted that the combination of the cited references does not teach or suggest the method as claimed. Accordingly, Appellants respectfully submit that the rejection of claims 1-8 and 10-15 as being obvious over Grinshpun and Nelson should be reversed, thereby permitting claims 1-8 and 10-15 to be passed to allowance.

C. Obviousness Rejection under 35 U.S.C. §103(a) over Claims 1-8, 10-12, 14, and 15

In rejecting claims 1-8, 10-12, 14, and 15 as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of U.S. Patent No. 6,589,646 to Morgenstern ("Morgenstern"), Appellants respectfully submit that the Office has incorrectly interpreted the cited references and has therefore failed to establish a *prima facie* case of obviousness.

In particular, Appellants respectfully submit that claim 1 defines a method of manufacturing a rigid foam board that is not taught or suggested by Grinshpun and Morgenstern. In addition, Appellants respectfully submit that neither Grinshpun nor Morgenstern teaches or suggests the combination of features recited in claim 1.

Grinshpun teaches a foamable composition that is extruded through a die having a plurality of orifices, each of which forms a hollow extrudate. (*See, e.g.*, page 2, lines 19-21 and page 20, lines 22-24). The hollow extrudate is converted into foamed hollow extrudate strands at a temperature that promotes bubble stability. (*See, e.g.*, page 2, lines 22-24 and

page 20, lines 26-28). The final step includes permitting the hollow strands to contact and adhere to each other to form a hollow, multi-strand polymer foam extrudate. (*See, e.g.*, page 2, lines 25-28 and page 20, lines 28-31).

Appellants respectfully submit that there is simply no teaching or suggestion within Grinshpun of extruding a polymer melt under a second pressure and at a second temperature where the second pressure and second temperature are sufficient to allow the polymer melt to expand and form a foam board as is required in claim 1. Indeed, the extrusion die in Grinshpun is specifically chosen so that it forms hollow tubes, not a foam board. It is through a coalescing step that these hollow tubes are joined together to form a hollow, multi-strand extrudate. (*See, e.g.*, page 2, lines 14-28 and page 20, lines 28-31 of Grinshpun). Appellants submit that there is no teaching or suggestion within Grinshpun of extruding a foam board as claimed in claim 1. Morgenstern does not teach or suggest a foam board, and as such, cannot make up for the deficiencies of Grinshpun. Accordingly, it is respectfully submitted that the combination of the teachings of Grinshpun and Morgenstern would not result in the inventive method of claim 1.

In the outstanding final Office Action, it is asserted that the foam sheet produced by the coalescing step is a foam board in accordance with the plain meaning of the term, and as a result, the rejection was maintained.⁸ Appellants respectfully disagree, and submit that, as discussed above, a "board" is a rigid material. Additionally, and as discussed above, it is well known to those of skill in the art that foam board insulation is a sheet of rigid foam used in nearly all aspects of building construction to provide thermal resistance. Accordingly, it is respectfully submitted that the foam "board" recited in the claims and described in the application defines a rigid structure.

As taught at least by Table 1 on page 10 of the application, the foam is extruded by a flat face die/shaper plate or a flat slot die. As one of skill in the art would appreciate, such dies form solid, rigid foam structures and *not* hollow tubes as are extruded by the multi-orifice die of Grinshpun. (*See, e.g.*, page 2, lines 19-21 and page 20, lines 22-24 of Grinshpun). Appellants respectfully submit that in the present invention, the foam board of claim 1 has a rigid foam structure, unlike the hollow tubular structures taught by Grinshpun.

⁸ *See, e.g.*, page 11, lines 3-4 of the Office Action dated November 20, 2008.

Moreover, it is respectfully submitted that the foam "sheet" formed by the coalesced hollow tubes of Grinshpun cannot be a rigid structure, at least partially due to the lack of material within the individual foam tubes. Indeed, Grinshpun expressly teaches that the hollow foam strands are flexible and compressible. (*See, e.g.*, page 10, lines 17-20 of Grinshpun). Accordingly, the foam structure of Grinshpun cannot be a foam board (*i.e.* rigid foam board) as is required by independent claim 1.

In addition, Appellants submit that Grinshpun teaches away from a method of manufacturing a rigid foam board that includes the step of extruding a polymer melt under a second pressure and at a second temperature that allows the polymer melt to expand and form a foam board. As discussed above, Grinshpun specifically teaches the extrusion of a hollow extrudate. (*See, e.g.*, page 2, lines 22-24 and page 20, lines 26-28). Additionally, as discussed previously, a board (*i.e.*, the claimed foam board) has a rigid structure. In contrast, the hollow tubes of Grinshpun are both flexible and compressible. (*See, e.g.*, page 10, lines 17-20 of Grinshpun). Appellants respectfully submit that there is no teaching or suggestion within Grinshpun of extruding a rigid foam board. It is therefore respectfully submitted that one of skill in the art reading Grinshpun would be drawn away from extruding a polymer melt under a second pressure and at a second temperature which permits the polymer melt to expand and form a foam board as is claimed in claim 1 because Grinshpun fails to teach a rigid structure. Accordingly, Grinshpun fails to constitute the substantial evidence necessary to render the claimed invention obvious as a matter of law.⁹

Additionally, Appellants submit that there is no motivation for one of skill in the art to arrive at a method of manufacturing a rigid foam board as claimed in claim 1 based on the disclosures of Grinshpun and Morgenstern. As is well established, in order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of

⁹ *See, e.g., In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596, 1599 (Fed. Cir. 1988) (holding it error to find obviousness where references as a whole "diverge from and teach away from the invention at hand.").

success must both be found in the prior art, and not based on applicant's disclosure.¹⁰ Additionally, obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so.¹¹

Appellants submit that one of ordinary skill in the art would simply not be motivated to arrive at the method of claim 1 that includes the step of extruding a polymer melt under a second pressure and at a second temperature that allows the polymer melt to expand and form a foam board based on the teachings of Grinshpun and Morgenstern because Grinshpun specifically teaches the extrusion of a hollow extrudate. Indeed, it is respectfully submitted that the hollow tubes of Grinshpun are both flexible and compressible and cannot be combined to form rigid structure such as a foam board. Additionally, Grinshpun teaches away from the method recited in claim 1. Accordingly, Appellants respectfully submit that the Office has failed to establish a *prima facie* case of obviousness.

Also, as discussed above, neither Grinshpun nor Morgenstern teaches or suggests a rigid foam board. Therefore, Appellants respectfully submit that Grinshpun and Morgenstern, alone or in combination, fail to teach all of the claim limitations set forth in claim 1. Accordingly, it is respectfully submitted that a *prima facie* case of obviousness has not been established for this additional reason.

In view of the above, it is respectfully submitted that independent claim 1 is not taught or suggested by Grinshpun and Morgenstern and that claim 1 is therefore non-obvious and patentable. With respect to dependent claims 2-8, 10-12, 14, and 15, Appellants submit that because independent claim 1 is not taught or suggested by Grinshpun or Morgenstern and claims 2-8, 10-12, 14, and 15 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2-8, 10-12, 14, and 15 are also not taught or suggested by Grinshpun and/or Morgenstern.

In sum, claims 1-8, 10-12, 14, and 15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of U.S. Patent

¹⁰ See, e.g., *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 6, August 2007, §2142.

¹¹ See, e.g., *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 6, August 2007, §2142 citing *In re Kahn*, 441 F.3d 977, 986, 78 USPQ2d 1329, 1335 (Fed. Cir. 2006).

No. 6,589,646 to Morgenstern ("Morgenstern"). It is respectfully submitted that the combination of the cited references does not teach or suggest the method as claimed. Accordingly, Appellants respectfully submit that the rejection of claims 1-8, 10-12, 14, and 15 as being obvious over Grinshpun and Morgenstern should be reversed, thereby permitting claims 1-8, 10-12, 14, and 15 to be passed to allowance.

D. Obviousness Rejection under 35 U.S.C. §103(a) over Claims 1-8, 10-12, 14-15, and 21

In rejecting claims 1-8, 10-12, 14-15, and 21 as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of WO 2003/055804 to Chen, *et al.* ("Chen") and U.S. Patent No. 7,160,929 to Tan ("Tan"), Appellants respectfully submit that the Office has incorrectly interpreted the cited references and has therefore failed to establish a *prima facie* case of obviousness.

It is respectfully submitted that Appellants attempted to cancel claim 21 in the response to the final Office Action; however, the amendment was denied entry.¹² Appellants respectfully submit that, in order to advance the prosecution of the case, Appellants desire to cancel claim 21 without prejudice. It is respectfully submitted that the cancellation of claim 21 would render the rejection of claim 21 moot.

With respect to the rejection claims 1-8, 10-12, and 14-15, Appellants submit that there is no teaching or suggestion within Grinshpun, Chen, and Tan of a method of manufacturing a rigid foam board as claimed in claim 1. In addition, Appellants respectfully submit that none of Grinshpun, Chen, and Tan teaches or suggests the combination of features recited in claim 1.

Grinshpun teaches a foamable composition that is extruded through a die having a plurality of orifices, each of which forms a hollow extrudate. (*See, e.g.*, page 2, lines 19-21 and page 20, lines 22-24). The hollow extrudate is converted into foamed hollow extrudate strands at a temperature that promotes bubble stability. (*See, e.g.*, page 2, lines 22-24 and page 20, lines 26-28). The final step includes permitting the hollow strands to contact and adhere to each other to form a hollow, multi-strand polymer foam extrudate. (*See, e.g.*, page

¹² See page 15, lines 15-17 of the Response After Final filed on January 16, 2009 and the Advisory Action dated January 29, 2009.

2, lines 25-28 and page 20, lines 28-31).

Appellants respectfully submit that there is simply no teaching or suggestion within Grinshpun of extruding a polymer melt under a second pressure and at a second temperature where the second pressure and second temperature are sufficient to allow the polymer melt to expand and form a foam board as is required in claim 1. Indeed, the extrusion die in Grinshpun is specifically chosen so that it forms hollow tubes, not a foam board. It is through a coalescing step that these hollow tubes are joined together to form a hollow, multi-strand extrudate. (*See, e.g.*, page 2, lines 14-28 and page 20, lines 28-31 of Grinshpun). Appellants submit that there is no teaching or suggestion within Grinshpun of extruding a foam board as claimed in claim 1. Chen and Tan do not teach or suggest a foam board, and as such, do not make up for the deficiencies of Grinshpun. Accordingly, it is respectfully submitted that the combination of the teachings of Grinshpun, Chen, and Tan would not result in the inventive method of claim 1.

In the outstanding final Office Action, it is asserted that the foam sheet produced by the coalescing step is a foam board in accordance with the plain meaning of the term, and as a result, the rejection was maintained.¹³ Appellants respectfully disagree, and submit that, as discussed above, a "board" is a rigid material. Additionally, and as discussed above, it is well known to those of skill in the art that foam board insulation is a sheet of rigid foam used in nearly all aspects of building construction to provide thermal resistance. Accordingly, it is respectfully submitted that the foam "board" recited in the claims and described in the application defines a rigid structure.

As taught at least by Table 1 on page 10 of the application, the foam is extruded by a flat face die/shaper plate or a flat slot die. As one of skill in the art would appreciate, such dies form solid, rigid foam structures and *not* hollow tubes as are extruded by the multi-orifice die of Grinshpun. (*See, e.g.*, page 2, lines 19-21 and page 20, lines 22-24 of Grinshpun). Appellants respectfully submit that in the present invention, the foam board of claim 1 has a rigid foam structure, unlike the hollow tubular structures taught by Grinshpun. Moreover, it is respectfully submitted that the foam "sheet" formed by the coalesced hollow tubes of Grinshpun cannot be a rigid structure, at least partially due to the lack of material

¹³ *See, e.g.*, page 11, lines 3-4 of the Office Action dated November 20, 2008.

within the individual foam tubes. Indeed, Grinshpun expressly teaches that the hollow foam strands are flexible and compressible. (See, e.g., page 10, lines 17-20 of Grinshpun). Accordingly, the foam structure of Grinshpun cannot be a foam board (*i.e.* rigid foam board) as is required by independent claim 1.

In addition, Appellants submit that Grinshpun teaches away from a method of manufacturing a rigid foam board that includes the step of extruding a polymer melt under a second pressure and at a second temperature that allows the polymer melt to expand and form a foam board. As discussed above, Grinshpun specifically teaches the extrusion of a hollow extrudate. (See, e.g., page 2, lines 22-24 and page 20, lines 26-28). Additionally, as discussed previously, a board (*i.e.*, the claimed foam boards) has a rigid structure. In contrast, the hollow tubes of Grinshpun are both flexible and compressible. (See, e.g., page 10, lines 17-20 of Grinshpun). Appellants respectfully submit that there is no teaching or suggestion within Grinshpun of extruding a rigid foam board. It is therefore respectfully submitted that one of skill in the art reading Grinshpun would be drawn away from extruding a polymer melt under a second pressure and at a second temperature which permits the polymer melt to expand and form a foam board as is claimed in claim 1 because Grinshpun fails to teach a rigid structure. Accordingly, Grinshpun fails to constitute the substantial evidence necessary to render the claimed invention obvious as a matter of law.¹⁴

In addition, Appellants submit that there is no motivation for one of skill in the art to arrive at a method of manufacturing a rigid foam board as claimed in claim 1 based on the disclosures of Grinshpun, Chen, and Tan. As is well established, in order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of

¹⁴ See, e.g., *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596, 1599 (Fed. Cir. 1988) (holding it error to find obviousness where references as a whole “diverge from and teach away from the invention at hand.”).

success must both be found in the prior art, and not based on applicant's disclosure.¹⁵ Additionally, obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so.¹⁶

Appellants submit that one of ordinary skill in the art would simply not be motivated to arrive at the method of claim 1 based on the teachings of Grinshpun, Chen, and Tan because none of Grinshpun, Chen, or Tan teaches or suggests method of manufacturing a rigid foam board that includes the step of extruding a polymer melt under a second pressure and at a second temperature that allows the polymer melt to expand and form a foam board as is required in independent claim 1. Indeed, the hollow tubes of Grinshpun are both flexible and compressible. Furthermore, Grinshpun teaches away from extruding a foam board. Accordingly, Appellants respectfully submit that the Office has failed to establish a *prima facie* case of obviousness.

Also, as discussed above, Grinshpun, Chen, and Tan, in any combination, do not teach or suggest a rigid foam board. Therefore, Appellants respectfully submit that Grinshpun, Chen, and Tan, alone or in any combination, fail to teach all of the claim limitations set forth in claim 1. Accordingly, it is respectfully submitted that a *prima facie* case of obviousness has not been established for this additional reason.

In view of the above, it is respectfully submitted that independent claim 1 is not taught or suggested by Grinshpun, Chen, and Tan and that claim 1 is therefore non-obvious and patentable. With respect to dependent claims 2-8, 10-12, 14, and 15, Appellants submit that because independent claim 1 is not taught or suggested by Grinshpun, Chen, and Tan and claims 2-8, 10-12, 14, and 15 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2-8, 10-12, 14, and 15 are also not taught or suggested by Grinshpun, Chen, and/or Tan.

In sum, claims 1-8, 10-12, 14, 15, and 21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of WO

¹⁵ See, e.g., *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 6, August 2007, §2142.

¹⁶ See, e.g., *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 6, August 2007, §2142 citing *In re Kahn*, 441 F.3d 977, 986, 78 USPQ2d 1329, 1335 (Fed. Cir. 2006).

2003/055804 to Chen, *et al.* ("Chen") and U.S. Patent No. 7,160,929 to Tan ("Tan"). It is respectfully submitted that the combination of the cited references does not teach or suggest the method as claimed. Accordingly, Appellants respectfully submit that the rejection of claims 1-8, 10-12, 14, 15, and 21 as being obvious over Grinshpun, Chen, and Tan should be reversed, thereby permitting claims 1-8, 10-12, 14, and 15 to be passed to allowance.

E. Obviousness Rejection under 35 U.S.C. §103(a) over Claim 21

The Office has rejected claim 21 as being unpatentable over WO 2001/40362 to Miller, *et al.* ("Miller") in view of WO 2003/055804 to Chen, *et al.* ("Chen") and U.S. Patent No. 7,160,929 to Tan ("Tan").

In the Amendment After Final filed on January 16, 2009, claim 21 was canceled without prejudice.¹⁷ Although this amendment was denied entry, Appellants desire to cancel claim 21 to advance the prosecution of the application and place the claims into condition for allowance. It is respectfully submitted that the cancelation of claim 21 would render this rejection moot.

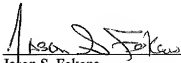
¹⁷ See page 15, lines 15-17 of the Response After Final filed on January 16, 2009 and the Advisory Action dated January 29, 2009.

VIII. CONCLUSION

Appellants hereby authorize the Commissioner to charge payment or credit any overpayment of fees necessitated by the filing of this Brief on Appeal, including the statutory filing fee of \$540.00 and any necessary extensions of time required to maintain pendency of this application, to Assignee's Deposit Account No. 50-0568.

Respectfully submitted,

Date: 5/27/09



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CLAIMS APPENDIX

CLAIMS ON APPEAL:

1. A method of manufacturing a rigid foam board consisting essentially of:
incorporating nano-particles into a polymer melt, said nano-particles being selected from calcium carbonate, intercalated graphites and expanded graphites and having a particle size in at least one dimension less than 100 angstroms;
incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature;
extruding the polymer melt under a second pressure and at a second temperature, the second pressure and second temperature being sufficient to allow the polymer melt to expand and form a foam board; and
cooling the foam board, said foam board having an average cell size between 60 μm and 120 μm and having a cell size distribution;
wherein said polymer melt includes an alkenyl aromatic polymer material.
2. A method of manufacturing a rigid foam board according to claim 1:
wherein the polymer includes at least one alkenyl aromatic polymer selected from alkenyl aromatic homopolymers, copolymers of alkenyl aromatic compounds and copolymerizable ethylenically unsaturated comonomers.
3. A method of manufacturing a rigid foam board according to claim 2:
wherein the polymer includes a major portion of at least one alkenyl aromatic polymer selected from the group consisting of the polymerization products of styrene, α -methylstyrene, chlorostyrene, bromostyrene, ethylstyrene, vinyl benzene and vinyl toluene;
and
a minor portion of a non-alkenyl aromatic polymer.

4. A method of manufacturing a rigid foam board according to claim 3:
wherein the polymer includes at least 80 wt% polystyrene.
5. A method of manufacturing a rigid foam board according to claim 2:
wherein the blowing agent includes at least one composition selected from aliphatic hydrocarbons having 1-9 carbon atoms, halogenated aliphatic hydrocarbons having 1-4 carbon atoms, carbon dioxide, nitrogen, water, azodicarbonamide and p-toluenesulfonyl.
6. A method of manufacturing a rigid foam board according to claim 5:
wherein the blowing agent includes at least one composition selected from methane, methanol, ethane, ethanol, propane, propanol, n-butane, isopentane, carbon dioxide, nitrogen, water, azodicarbonamide, p-toluenesulfonyl, HCFC-142b and HCFC-134a.
7. A method of manufacturing a rigid foam board according to claim 2, further comprising:
incorporating an additive into the polymer melt before forming the foam.
8. A method of manufacturing a rigid foam board according to claim 7:
wherein the additive includes at least one composition selected from flame retardants, mold release agents, pigments and fillers.
10. A method of manufacturing a rigid foam board according to claim 2:
wherein the nano-particles are incorporated into the polymer melt at a rate between 0.01 and 10 weight percent, based on polymer weight.

11. A method of manufacturing a rigid foam board according to claim 2:
wherein the nano-particles are incorporated into the polymer melt at a rate between 0.5 and 5 weight percent, based on polymer weight.
12. A method of manufacturing a rigid foam board according to claim 11:
wherein the polymer includes a major portion of polystyrene, polyethylene or polymethyl methacrylate.
13. A method of manufacturing a rigid foam board according to claim 10:
wherein the nano-particles are formed by a technique selected from intercalation with polystyrene and exfoliation of expandable graphite particles in a polystyrene or polymethyl methacrylate matrix.
14. A method of manufacturing a rigid foam board according to claim 2, wherein:
the average cell wall thickness is less than about 10 μm ;
the average strut diameter is less than about 20 μm ;
the cell orientation is between about 0.5 and 2.0; and
the foam density is less than about 100 kg/m^3 .
15. A method of manufacturing a rigid foam board according to claim 14, wherein:
the average cell wall thickness is between about 0.2 and about 1.0 μm ;
the average strut diameter is between about 4 and about 8 μm ;
the cell orientation is between about 1.0 and about 1.5; and
the foam density is between about 20 and about 50 kg/m^3 .
21. A method of manufacturing a rigid foam board consisting essentially of:
incorporating acicular calcium carbonate and at least one nucleating agent into a polymer melt, said acicular calcium carbonate having a particle size in at least one dimension less than 100 angstroms;
adding a blowing agent to said polymer melt under a first pressure and at a first temperature;

extruding said polymer melt under a second pressure and at a second temperature, said second pressure and said second temperature being sufficient to allow said polymer melt to expand and form a foam board; and

cooling said foam board;

wherein said polymer melt includes an alkenyl aromatic polymer material, and

wherein said foam has a cell orientation of at least about 1.4.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None